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(54) Method and apparatus for taking up narrow sheet member.

(57) A method and apparatus for taking up a narrow sheet member which is a tyre component in which disordered winding by detecting a difference between a delivery velocity and a takeup velocity of the narrow sheet member using a dancer member, and by controlling a drive motor of a bobbin using the detected signal in such a way that the takeup velocity and the delivery velocity are equal to each other.

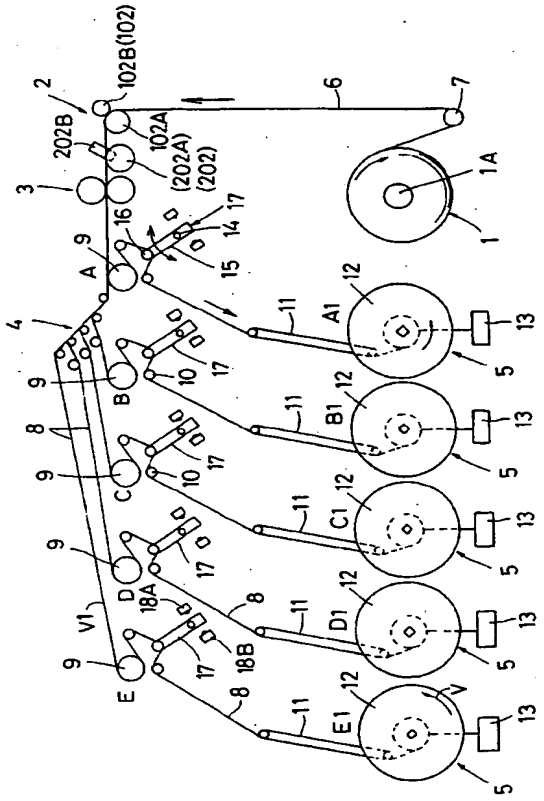

FIG. 1

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This invention relates to a method and apparatus for taking up a narrow sheet member which is utilised for the manufacture of a tyre component such as a thread or cord reinforcement-containing rubber sheet or a nylon strip.

Japanese Unexamined Patent Publication Hei 5(1993)-8321) discloses a technique for rewinding a sheet member such as a cord-containing rubber sheet which has previously been prepared in a wide form, splitting the sheet into several narrow sheets or strips, delivering the narrow sheets in the longitudinal direction thereof, and winding the sheet members around a bobbin one by one.

The prior art disclosed in the foregoing patent publication is effective to a certain extent, but can give variations in winding tension on a bobbin, and hence disordered winding, when a difference between its delivery velocity and the takeup velocity of the narrow sheet members is caused by variations in takeup diameter or the like.

Hence, the object of the present invention is to provide a takeup method and apparatus which can prevent disordered winding and enables even takeup of narrow sheet members while the adhesion or sticking together to the sheet members, coiled around a bobbin, is prevented.

According to a first aspect of this invention, there is provided a narrow sheet member takeup method comprising the steps of splitting a wide sheet member into a number of narrow sheet members, delivering the split narrow sheet members in the longitudinal direction thereof, spirally winding the narrow sheet members around bobbins, respectively, characterised by detecting a difference between a delivery velocity and a takeup velocity of the narrow sheet members by means of dancer members provided in the path of delivery of the narrow sheet members, and controlling drive motors of the bobbins in such a way that the takeup velocity equals the delivery velocity using the detected signal.

According to a second aspect of this invention, there is provided a narrow sheet member takeup apparatus on which a wide sheet member may be split into a number of narrow sheet members, and the narrow sheet members thus split are delivered in the longitudinal direction thereof, and coiled around bobbins one by one, characterised by dancer members provided in the path of delivery of narrow sheet members for detecting a difference between delivery velocity and takeup velocity of the narrow sheet members, drive motors which drive bobbins controlled by means to ensure the takeup velocity equals the delivery velocity using the detected signal, and movable guide members which travel back and forth in the axial direction of the bobbins to shift the position of the narrow sheet members.

As a result the wide sheet member, consisting of a ply master roll such as a cord-containing rubber sheet coiled in the form of a roll, can be rewound. This wide sheet member is then delivered to the bobbins of the takeup apparatus in the longitudinal direction of the sheet member by means of a delivery means.

During the course of delivery of the wide sheet member, it is split into several narrow sheet members by a slitting means and a splitting means. The narrow sheet members thus split are spirally coiled around the bobbins, respectively.

When there arises a difference between the delivery velocity and the takeup velocity of the narrow sheet members, the dancer members carry out dancer operations, and a switching means detects the velocity difference. The narrow sheet members are taken up by controlling the drive motors in such a way that the takeup velocity equals the delivery velocity using this detected signal. The guide members travel back and forth in the axial direction of the bobbins, whereby the narrow sheet members are spirally taken up with a constant tension.

Further aspects of the invention will be apparent from the following description, by way of example only, of one embodiment in conjunction with the attached diagrammatic drawings in which:

Figure 1 is an elevation of the entire construction showing a preferred embodiment of a narrow sheet member takeup apparatus according to this invention;

Figures 2A through 2C are explanatory views illustrating the operation of the takeup apparatus, where Figure 2A shows the operation when the delivery velocity and the takeup velocity are equal to each other, Figure 2B shows the operation when the delivery velocity is faster than the takeup velocity, and Figure 2C shows the operation when the delivery velocity is slower than the takeup velocity; and

Figures 3A and 3B are respectively a front view and a side elevation view, each showing a relationship between a guide member and a bobbin.

The apparatus comprises a rewinding unit 1, a slitting means 2, a delivery means 3, a splitting means 4 and a takeup unit 5.

The rewinding unit 1 is designed to rewind a wide sheet member 6, which is a ply master roll such as a cord-containing rubber, provided wound or rolled around a spool 1A having an air brake. The wide sheet member 6 is delivered to the delivery means 3 by way of the slitting means 2 disposed in the path of delivery of the wide sheet member 6 through a guide roll 7.

The slitting means 2 comprises a score cutter 102 and a leather cutter 202 which is disposed after the score cutter in the delivery direction. The score cutter 102 cuts deeply into the wide sheet member 6 by pressing a round cutter 102B against a smooth roll 102A, and the leather cutter 202 is designed to split the sheet member 6 by inserting a thin blade 202B into a grooved roll 202A.

The delivery means 3 shown as a roll is disposed downstream from the slitting means 2. The splitting means 4 consisting of a group of rolls is provided downstream from the delivery means 3. The wide sheet member 6 is split into several pieces, in this embodiment five sheets 8, by the splitting means 4 and the slitting means 2. These five sheets 8 are delivered to five bobbins 12 of a takeup apparatus 5 by tension rollers 9, guide rollers 10 and guide members 11. Each narrow sheet member 8 is spirally wound around each bobbin 12.

The tension rollers 9 are marked A-E in the order of length of delivery from shorter to longer. The tension rollers 9 are designed to prevent splitting failure after the narrow sheet members 8 have been split and slack of the sheet by gradually increasing the peripheral velocities of the tension rollers 9 so that the roller 9E moves faster than the roller 9A.

The takeup apparati 5 are also marked A1-E1 corresponding to the tension rollers 9. Any one of the takeup apparati 5 is provided with a flanged bobbin 12 which is rotated around the horizontal axis by the drive motor 13, and each apparatus 5 is also provided with a guide member 11 which may reciprocate in the axial direction of the bobbin 12 and also move pivotally.

Dancer members 17 vertically pivoted on fulcrums 14 are provided near the guide rollers 10 in the path of the delivery of the sheet 8 between the tension rollers 9 and the guide members 11. In each dancer member 17, a roller 16 is disposed at the end of an arm 15, and the roller 16 is brought into contact with the narrow sheet member 8, so that it becomes possible for the roller 16 to perform the dancer movement. Thereby, the difference between takeup velocity V and a delivery velocity VI is detected.

In other words, as shown in Figure 2A, when the takeup velocity V and the delivery velocity VI are equal to each other, the dancer member 17 is positioned at a neutral location. However, when $V < VI$ occurs because of variations in takeup diameter, the dancer member 17 pivots downwardly under its own weight as shown in Figure 2B. This downward pivotal movement is detected by an adjacent switch such as a detector 18A which serves as a switching means. On the basis of this detected signal, the drive motor 13 is controlled to accelerate until $V = VI$. On the other hand, when $V > VI$, the dancer member 17 pivots upwardly as shown in Figure 2C. This upward pivotal movement is detected by detector 18B which serves as a switching means, and the drive motor 13 is controlled to decelerate until $V = VI$.

The narrow sheet member 8 is directly coiled around the bobbin 12 in a spiral manner, the diameter of the bobbin 12 is more than 100mm. This is intended to prevent the sheet member from being susceptible to remaining in a coiled shape afterwards which tends to occur if the diameter is less than 100mm.

The guide members 11, as shown in Figures 3A and 3B, have a base fitted around a screw shaft 20, which is reversely moveable by means of the motor and a reverse clutch 19, in such a way that it is turned to reciprocate in the direction parallel to the axial direction of the bobbin. The end of the guide member 11 is movable so as to be close to and far away from the outer peripheral surface of the bobbin 12 by means of an oscillating rotary driving body 21, and hence the guide member 11 follows the diameter of the coiled sheet. For this reason, a detector 22 such as a photoelectric switch is provided at the end of the guide member 11, and the oscillating rotary driving body 21 is designed to actuate by this detected signal.

As shown in Figure 2A, when the narrow sheet member 8 is directly coiled around the bobbin 12 in a spiral manner by causing the guide member 11 to travel parallel to the axial direction of the bobbin, the wrapping angle θ is set in the range from 0.02 to 5°, more preferably, in the range from 0.04 to 1.5°.

If the sheet is directly coiled around the bobbin in a spiral manner at a wrapping angle of less than 0.02°, the amount of overlap between the narrow sheet members 8 increases. In this case, the sheet members 8 adhere too closely to each other because of their stickiness. However, if the wrapping angle exceeds 5°, the torsional force which acts on the narrow sheet member 8 becomes larger, and in some cases a kink occurs at a turnover point of the sheet member 8.

Moreover, when the narrow sheet members 8 need to be joined to each other, it is desirable for the sheet members 8 to be connected in the form of a joint structure J shown in Figure 3B. This is because it is possible to prevent the sheet members 8 from being disconnected from each other or becoming loose by pulling of the joint structure J when the sheet members 8 are rewound from the bobbin 12.

Means other than that shown in the drawings may be used as the slitting means 2, and the score cutter and the leather cutter may be positioned in reverse order. Alternatively, either one of the score cutter and the leather cutter may be sufficient. As shown by a dotted line in Figure 2A, each of the detectors 18A and 18B, serving as the switching means, may be constituted by a pair of detectors, and hence they may consist of four detectors in total. Instead of these adjacent switches, an angle may be detected by an encoder.

As mentioned above, according to the present invention, it is possible to take up a narrow sheet member evenly and orderly retaining its shape without the use of a liner, while the rewinding of the sheet member is kept simple.

Details of the invention has now been described in detail. It is to be noted, however, this is merely illustrative of the principles underlying the inventive concept. It is contemplated that various modifications

of the disclosed embodiment, as well as other embodiments of the invention will, without departing from the spirit and scope of the invention, be apparent to those who are versed in the art.

Claims

1. A narrow sheet member takeup method comprising the steps of splitting a wide sheet member (6) into a number of narrow sheet members (8), delivering the split narrow sheet members (8) in the longitudinal direction thereof, spirally winding the narrow sheet members (8) around bobbins (12), respectively, characterised by detecting a difference between a delivery velocity and a takeup velocity of the narrow sheet members (8) by means of dancer members (17) provided in the path of delivery of the narrow sheet members (8), and controlling drive motors (13) of the bobbins (12) in such a way that the takeup velocity equals the delivery velocity using the detected signal.

2. A narrow sheet member takeup method according to claim 1, characterised in that slack of the narrow sheet members (8) is prevented by gradually increasing the peripheral velocities of the rollers so that those rollers have a longer delivery distance for the narrow sheet members move faster than those rollers having a shorter delivery distance for the narrow sheet member.

3. A narrow sheet member takeup method according to claim 1 or 2, characterised in that the angle of wrapping the narrow sheet member around the bobbin is in the range between 0.02 to 5°.

4. A narrow sheet member takeup apparatus in which a wide sheet member (6) is split into a number of narrow sheet members (8), and the narrow sheet members (8) thus split are delivered in the longitudinal direction thereof, and the narrow sheet members (8) are coiled around bobbins (12) one by one, characterised in that the takeup apparatus comprises dancer members (17) provided in the path of travel of the narrow sheet members (8) for detecting a difference between a delivery velocity and a takeup velocity of the narrow sheet members (8), drive motors (13) which drive bobbins (12) controlled in such a way that the takeup velocity equals the delivery velocity by means of the detected signal; and guide members (11) which travel back and forth in the axial direction of the bobbins (12) and shift the position of the narrow sheet members (8).

5. A narrow sheet member takeup apparatus according to claim 4, characterised in that tension rollers (9) which pull and deliver the narrow sheet members (8) are provided in the path of the delivery of the narrow sheet members upstream from the dancer members (17), and the peripheral velocities of the tension rollers (9) are gradually increased so that the tension rollers (9) having a longer delivery distance for the narrow sheet member (8) gradually move faster than the tension rollers having a shorter delivery distance for the narrow sheet member.

6. A narrow sheet member takeup apparatus according to claim 4 or 5, characterised in that the dancer members (17) comprise rollers (16) that are disposed on the end of arms (15), which vertically pivot on fulcrums, and come into contact with the narrow sheet members.

7. A narrow sheet member takeup apparatus according to claim 4, 5 or 6, characterised in that the bobbin (12) around which the narrow sheet member is spirally coiled has a diameter more than 100mm.

FIG. 1

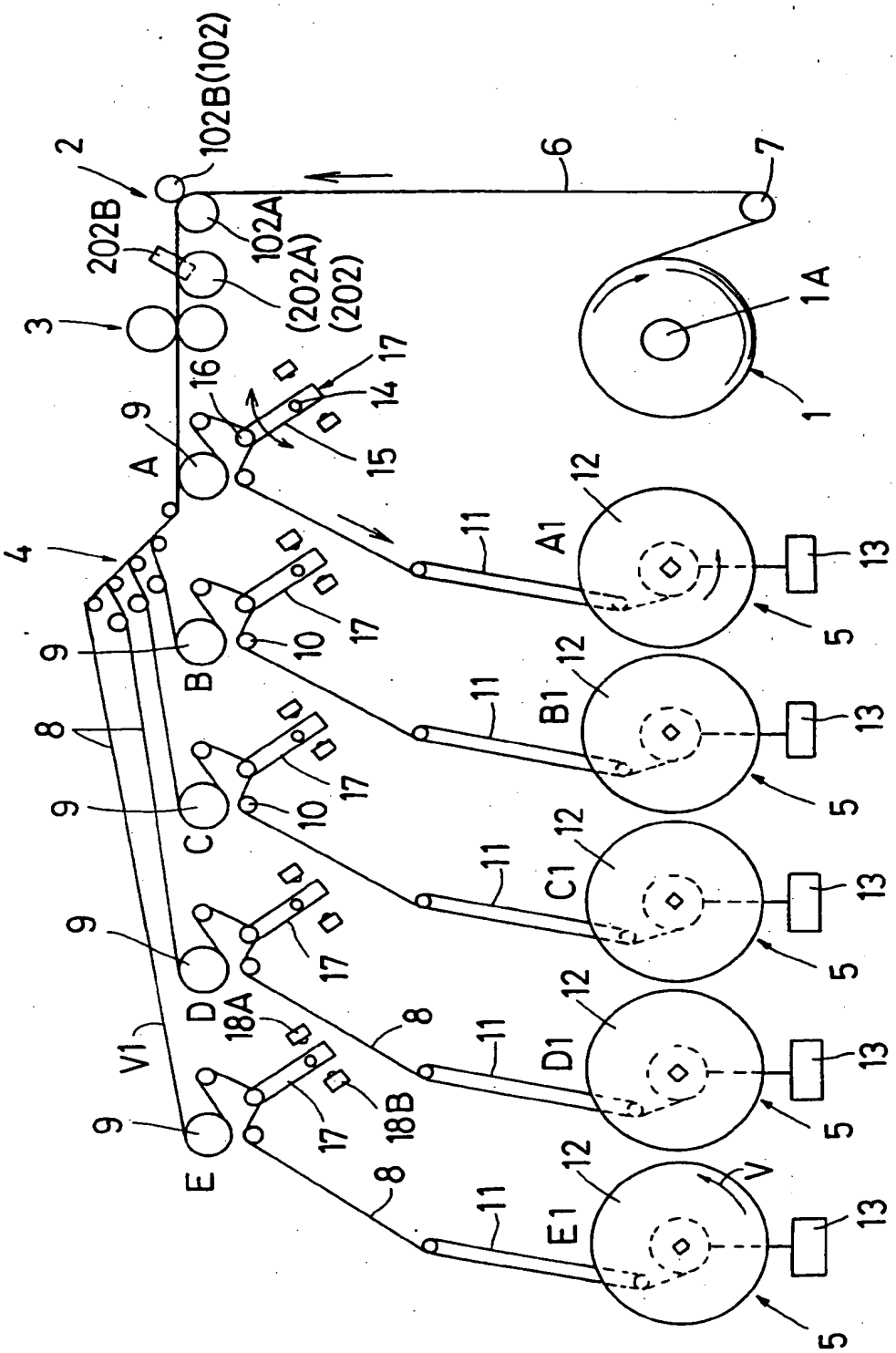


FIG. 2

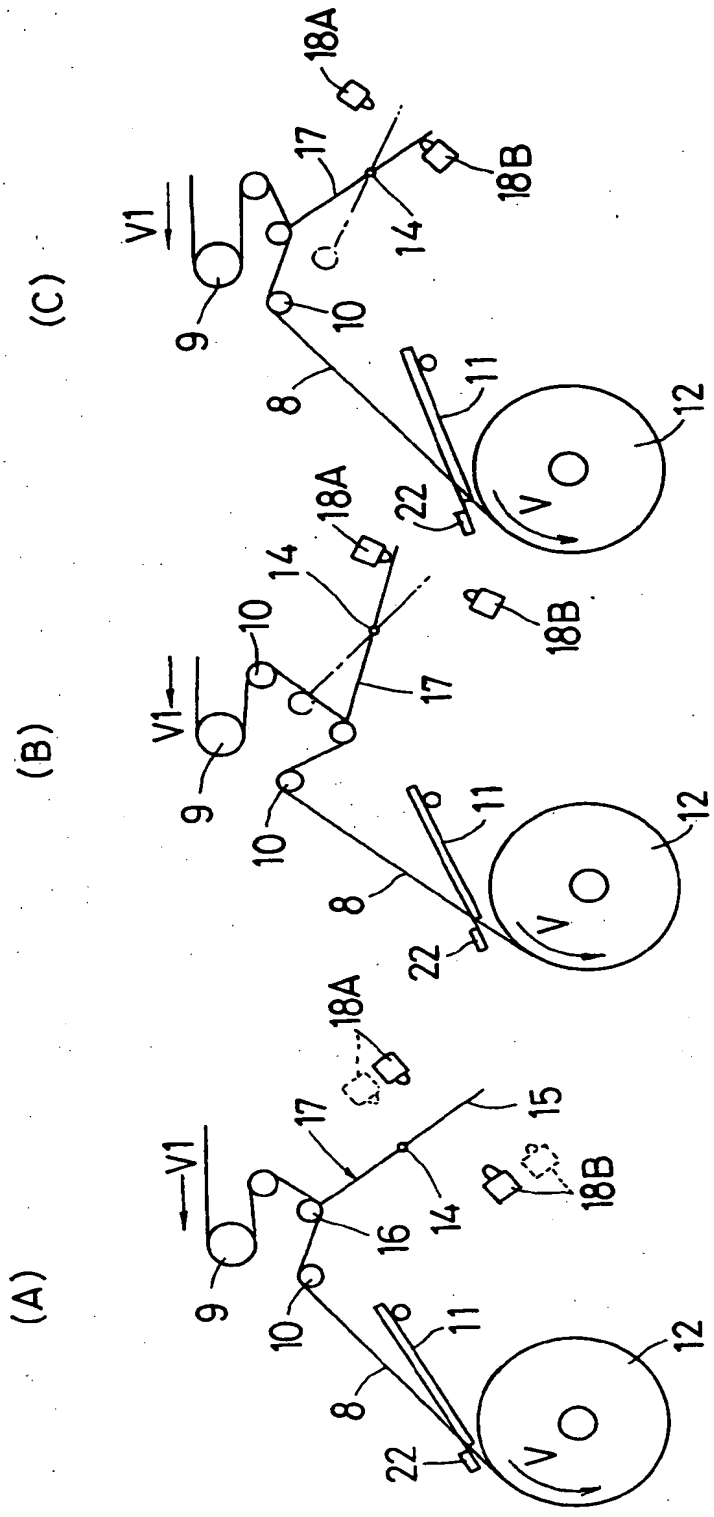
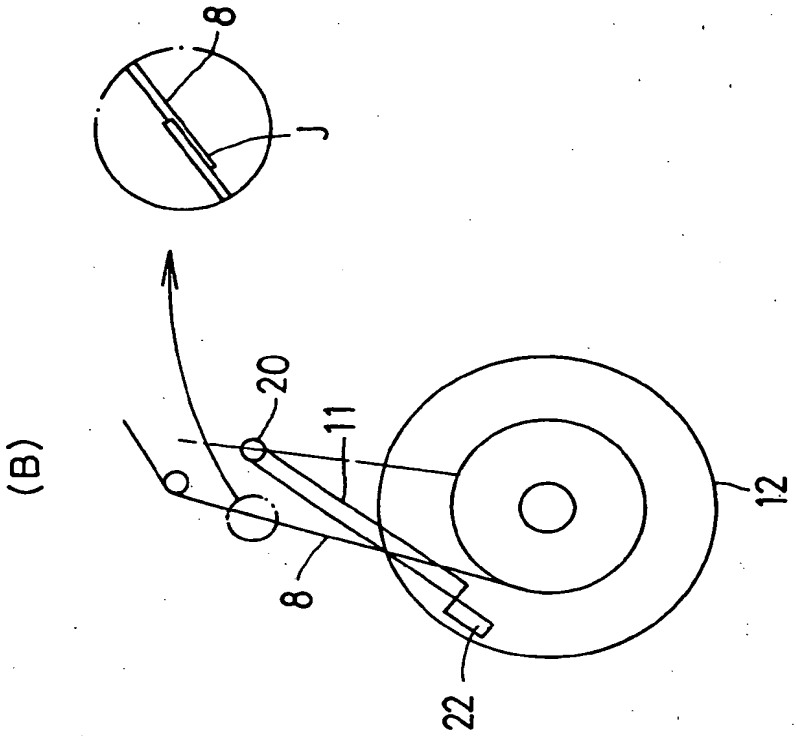
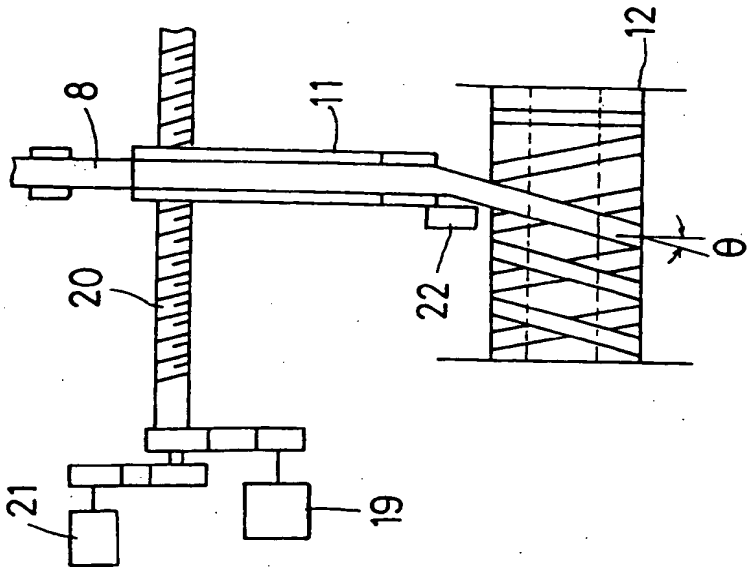


FIG. 3





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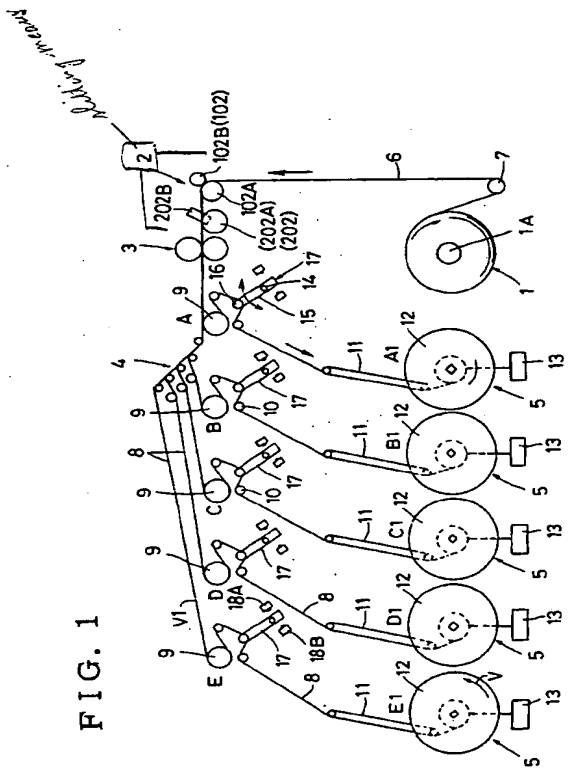

FIG. 1

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EUROPEAN SEARCH REPORT

Application Number
EP 94 30 7728

DOCUMENTS CONSIDERED TO BE RELEVANT

Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (Int.Cl.6)
X A	US-A-4 293 101 (V. I. DUNAEVSKY ET AL.) * the whole document * ---	1,4,6 3	B65H23/198 B65H18/10 //B65H23/02, B65H35/02, B29D30/38, B29K21:00, B29K105:10
X	US-A-4 447 016 (E. R. ENBERG ET AL.) * column 4, line 23 - line 39; figure 2 * * column 5, line 46 - column 6, line 14; figures 1,10 * * column 6, line 43 - line 68 * ---	1,4	
X	FR-A-2 054 738 (SOC. FRANC. D'EMBALLAGES) * page 3, line 5 - line 29; figure 1 * * page 7, line 24 - page 9, line 9; figures 9,10 * ---	1,4	
Y	FR-A-1 226 830 (POLETTI & OSTA) * the whole document * ---	1,4	
D,Y	PATENT ABSTRACTS OF JAPAN vol. 17 no. 275 (M-1418) ,27 May 1993 & JP-A-05 008321 (SUMITOMO RUBBER IND.) 19 January 1993, * abstract; figure 1 * ---	1,4	TECHNICAL FIELDS SEARCHED (Int.Cl.6) B65H
A	PATENT ABSTRACTS OF JAPAN vol. 10 no. 142 (M-481) ,24 May 1986 & JP-A-60 262766 (TORAY K. K.) 26 December 1985, * abstract; figure 1 * ---	1,4	
A	US-A-5 178 341 (J. W. DITTO) * the whole document * ---	1,4	
A	US-A-1 977 197 (H. E. NEUS) * page 2, line 74 - line 141; figure 2 * * page 2, line 142 - page 3, line 84; figure 3 * ---	1,4,6	
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The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
THE HAGUE	10 July 1995	Fregosi, A

CATEGORY OF CITED DOCUMENTS

X : particularly relevant if taken alone
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EUROPEAN SEARCH REPORT

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DOCUMENTS CONSIDERED TO BE RELEVANT

Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (Int.Cl.6)
A	FR-A-1 245 786 (ALLMÄNNA SVENSKA ELEKTRISKA AKT.) * the whole document * ---	1,4	
A	PATENT ABSTRACTS OF JAPAN vol. 14 no. 119 (M-945) ,6 March 1990 & JP-A-01 316253 (TOYO TIRE & RUBBER CO.) 21 December 1989, * abstract; figure * -----	1,4	

TECHNICAL FIELDS SEARCHED (Int.Cl.6)

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